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ABSTRACT

This study examined the academic and social experiences of first-year female and visible minority group science students at "Big U," a large multi-racial and multi-cultural commuter university, located in a central Canadian city. In 1992, a total of 498 incoming science students were surveyed in September, November, and February-March of the first year. Response rates for the surveys were 89 percent, 84 percent, and 68 percent, respectively. Data were also gathered through focus groups and administrative records. The study found that first-year grade point averages varied by neither gender nor minority group status. Overall, female and minority group students reported that they had been treated by faculty, staff, and students in the same way that other students had been treated. Female students reported more contacts with faculty and staff, belonged to fewer campus organizations, and participated in fewer sports activities than male students. Males reported being more satisfied with the quality of instruction and their grades than did female students. When compared to other groups, female and minority group students encountered more problems relevant to university life, and female students indicated less self-confidence. (MDM)

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THE EXPERIENCE OF FEMALE AND MINORITY STUDENTS IN FIRST YEAR

J. PAUL GRAYSON

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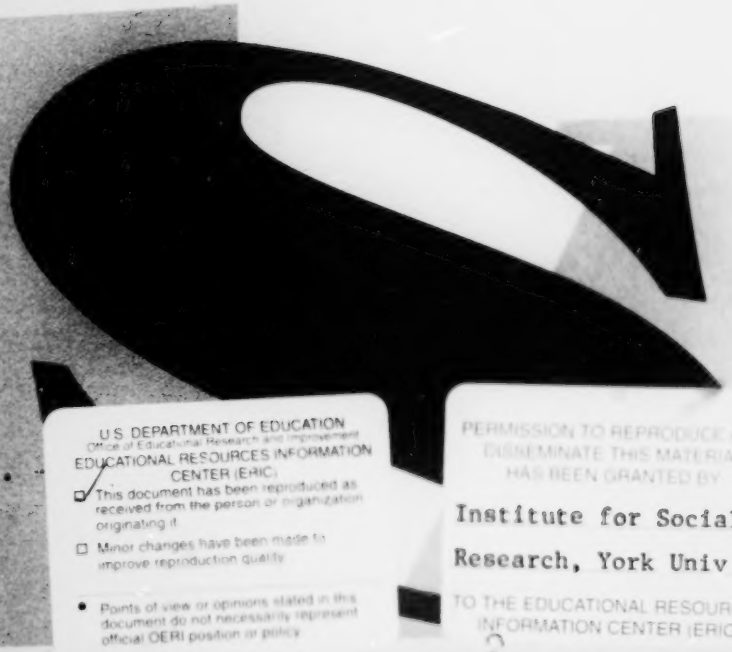

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The Experience of Female and Minority Students in First Year Science

J. Paul Grayson
Institute for Social Research

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Other Publications on York Students

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Summary

In contrast to some former research focusing on female and minority science students, at BigU, a large multi-racial and multi-cultural commuter university located in a large Canadian city, it was found that first year grade point averages, one outcome of the first year experience, varied by neither gender nor visible minority group status. In addition, females and visible minority group students felt that they had been treated by faculty, staff, and students in the same way that other students had been dealt with. With regard to university experiences, however, there are some differences related to gender and/or visible minority group status; nonetheless, as many of these experiences have been found to be unimportant to a number of outcomes of the first year science experience at BigU, the relevance of differences can be questioned. More serious, although not necessarily attributable to the university experience, is that along a number of dimensions the self-confidence of female students remained relatively low over the course of the first year of study in science.

Introduction

Concern with the negative university experiences of female and visible minority students, particularly in science, has been raised in a number of countries. While the particular focus and findings of studies vary, many have the underlying themes that:

- The curriculum frequently excludes materials and approaches of relevance to females and minorities.
- The teaching/learning environment, through various means, is 'chilly' to females and minorities.
- In part because of the foregoing, a relative lack of self-confidence on the part of females and minorities is sustained in institutions of higher learning.
- Certain outcomes, such as academic achievement and degree completion, are low for certain groups of minority students. Other outcomes, such as pursuing a career in science, are low for female students.[1]

In order to address these issues, BigU, a large multi-racial and multi-cultural commuter university located in a large Canadian city, in 1992 carried out a study of 498 of incoming science students. Data for the study were collected through three surveys conducted on the second day of classes in September, in mid-November, and toward the end of February and in early March. Response rates for the surveys were 89%, 84%, and 68% respectively. Information gained through surveys was supplemented through insights

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[1] Studies focusing on these issues include the following: Alexander Astin, What Matters in College. San Francisco: Jossey Bass, 1993. Alexander Astin and Helen S. Astin, Undergraduate Science Education. HERI, Los Angeles: University of California, 1992. Marcia Baxter-Magolda, Knowing and Reasoning in College. San Francisco: Jossey Bass, 1992. F. P. Collea, "Increasing Minorities in Science and Engineering: A Critical Look at Two Programs," Journal of College Science Teaching. 41, 1990. R. M. Hall, and B.R. Sandler, "The Classroom Climate: A Chilly One for Women," Project on the Status and Education of Women, Association of American Colleges, 1982. N. Nevitte, et al, "The Career Goals of Female Science Students in Canada," The Canadian Journal of Higher Education. 18, 1988. J. Oakes, "Opportunities, Achievement, and Choice: Women and Minority Students in Science and Mathematics," Review of Research in Education. 16, 1990. J. Oakes, Multiple Inequalities: the Effects of Race, Social Class, and Tracking on Opportunities to Learn Mathematics and Science. Santa Monica: Rand Corporation, 1990. L. B. Rosenfeld and M.W. Jarrard, "The Effects of Perceived Sexism in Female and Male College Students' Descriptions of Classroom Climate," Communication Education. 34, 1985. S. V. Rosser, Female Friendly Science. New York: Pergamon Press, 1990. Sheila Tobias, They're Not Dumb, They're Different. Tuscon: Research Corporation, 1990. Sheila Tobias, Revitalizing Undergraduate Science. Tuscon: Research Corporation, 1992. Norma C. Ware et al, "Undergraduate Women: Who Chooses a Science Major?" Journal of Higher Education. 56, 1985. Dana Williams, "Is the Post-secondary Classroom a Chilly One for Women?" The Canadian Journal of Higher Education. 20, 1990.

obtained in focus group meetings conducted concurrently with the surveys and by data obtained from administrative records. While the current report is based primarily on the results of the final survey, where relevant, reference will also be made to earlier surveys.

In contrast to some former research focusing on female and minority science students, at BigU it was found that first year grade point averages, one outcome of the first year experience, varied by neither gender nor visible minority group status. In addition, females and self-identified visible minority group students felt that they had been treated by faculty, staff, and students in the same way that other students had been dealt with. With regard to university experiences, however, there are some differences related to gender and/or visible minority group status; nonetheless, as many of these experiences have been found to be unimportant to a number of outcomes of the first year science experience at BigU, the relevance of differences can be questioned. More serious, although not necessarily attributable to the university experience, is that along a number of dimensions the self-confidence of female students remained relatively low.

First Year Marks

The first year grade point averages of students, their gender, and their marks in the final year of high school, were available from administrative records. As a result, information on these variables is available for all students. Unfortunately, administrative records do not contain information regarding whether or not students consider themselves members of visible minority groups: surveys had to be relied on for information on this dimension. As surveys did not include all students (see response rates above), there is less information available on visible minority status than on gender and other concerns.

The final mean grade point average for all first year science students was 4.32 (which translates into a mark between 60% and 65%). After adjustments were made for marks in the final year of high school, the respective means for female and male students were 4.20 and 4.41. These differences are both absolutely and statistically insignificant. For all intents and purposes the academic achievement of males and females was identical.

When visible minority students are compared to others, after adjustments are made for marks in the final year of high school, the mean grade point average for the former is 4.55; for the latter, 4.76. Once again the differences are neither absolutely nor statistically significant. In essence, in terms of final grade point average, neither females nor visible minority students were disadvantaged.

Equal Treatment

In an earlier report it was shown that in September of the first year the overwhelming majority of both male and female students expected that female students would be treated the same way as other students by faculty, staff and students; however, visible minority students were slightly less inclined to expect that they would be treated equally.[2]

The initial concern of visible minority students notwithstanding, by the time of the final first year survey, the e were no differences between visible minority and other students when they were asked to disagree or agree with a statement that visible minority students had been treated equally by faculty, staff, and students. On a five point scale, with 1 meaning strongly disagree and 5 meaning strongly agree, the score for minorities was 4.32; for non-minorities, 4.52. In essence, scores are virtually identical.

The same is true with regard to equal treatment for females. The mean score on a similarly worded statement was 4.41 for females and 4.53 for males. In short, neither females nor members of visible minority students experienced differential treatment from faculty, staff, or students.

Academic and Social Involvement

Numerous studies have demonstrated that the amount of out-of-class contact students have with faculty, teaching assistants (lab demonstrators), and staff may have important implications for a number of desired outcomes of the university experience such as academic achievement, cognitive development, satisfaction with the educational experience, and so on. As noted elsewhere, however, many of the variables commonly placed in the academic and social involvement category, such as out-of-class contacts with faculty, participation in informal academic activities, participation in clubs, being involved in sports, and so on, were of no consequence at BigU for various outcomes including, expected marks, satisfaction with marks, satisfaction with the science program, increases in tolerance, preferences for independent learning, assessments of the value of a university and a BigU degree, and the likelihood of returning to BigU and/or science the following Fall.[3] This fact notwithstanding, there are some differences related to gender and minority group status in terms of participation in various activities.

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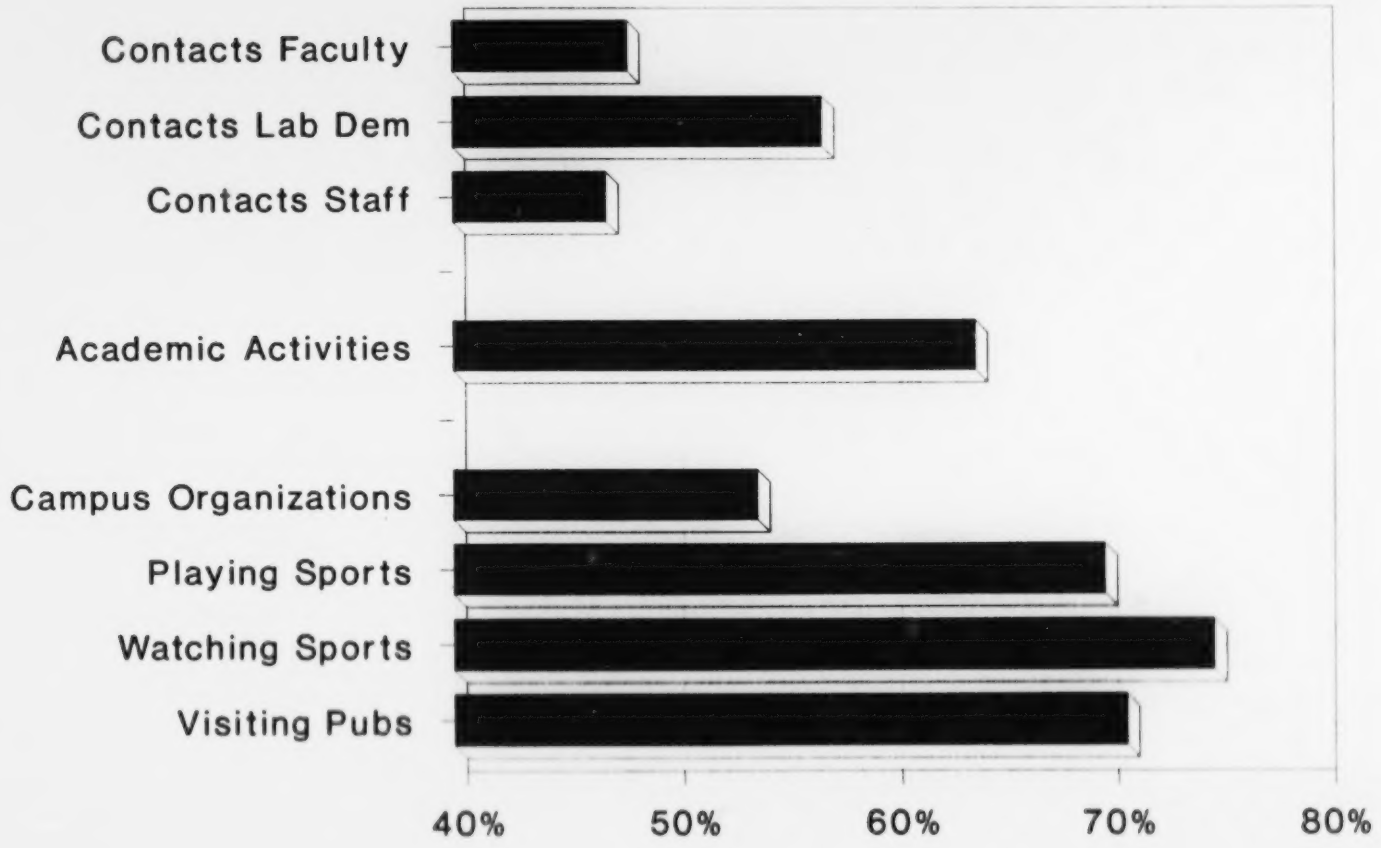
[2] J. Paul Grayson, Report #1: Preliminary Findings, Survey 1. Institute For Social Research, Internal Document, 1992.

[3] J. Paul Grayson, Improving First Year Science Education in a Commuter University. York University: Institute for Social Research, 1993.

Graph 1: Students Indicating No Involvement in Activities



Before analyzing such differences it is important to point out that the vast majority of BigU first year science students have little connection with the university apart from their attendance at classes. As illustrated in Graph 1:

- 48% of students report no out-of-class contacts with faculty.
- 57% no similar contacts with lab demonstrators.
- 47% no contacts with staff.
- 64% have participated in no informal academic activities.
- 54% are members of no campus organizations.
- 70% have engaged in no campus sports.
- 75% have not watched any campus sports.
- 71% do not regularly visit campus pubs.

By way of comparison, on average, students made 14 new friends since the beginning of class in September and spent 7.5 hours a week with these new friends. As the average number of hours per week spent on campus is 28, it would seem that a good percentage of time on campus is passed in the company of friends. In short, outside of formal classroom activities, few students are connected to the university; nonetheless, students appear to have developed important friendship networks in which they participate to a considerable extent.

While the above figures suggest little overall involvement of BigU science students in many activities, there were some differences between males and females and/or minorities and non-minorities. (Here and in the remainder of the report differences are mentioned only if they are statistically significant.)

- Female students had more contacts of ten minutes or more with staff over the previous two months than males: the mean contacts for females were 1.67; for males, 1.19.

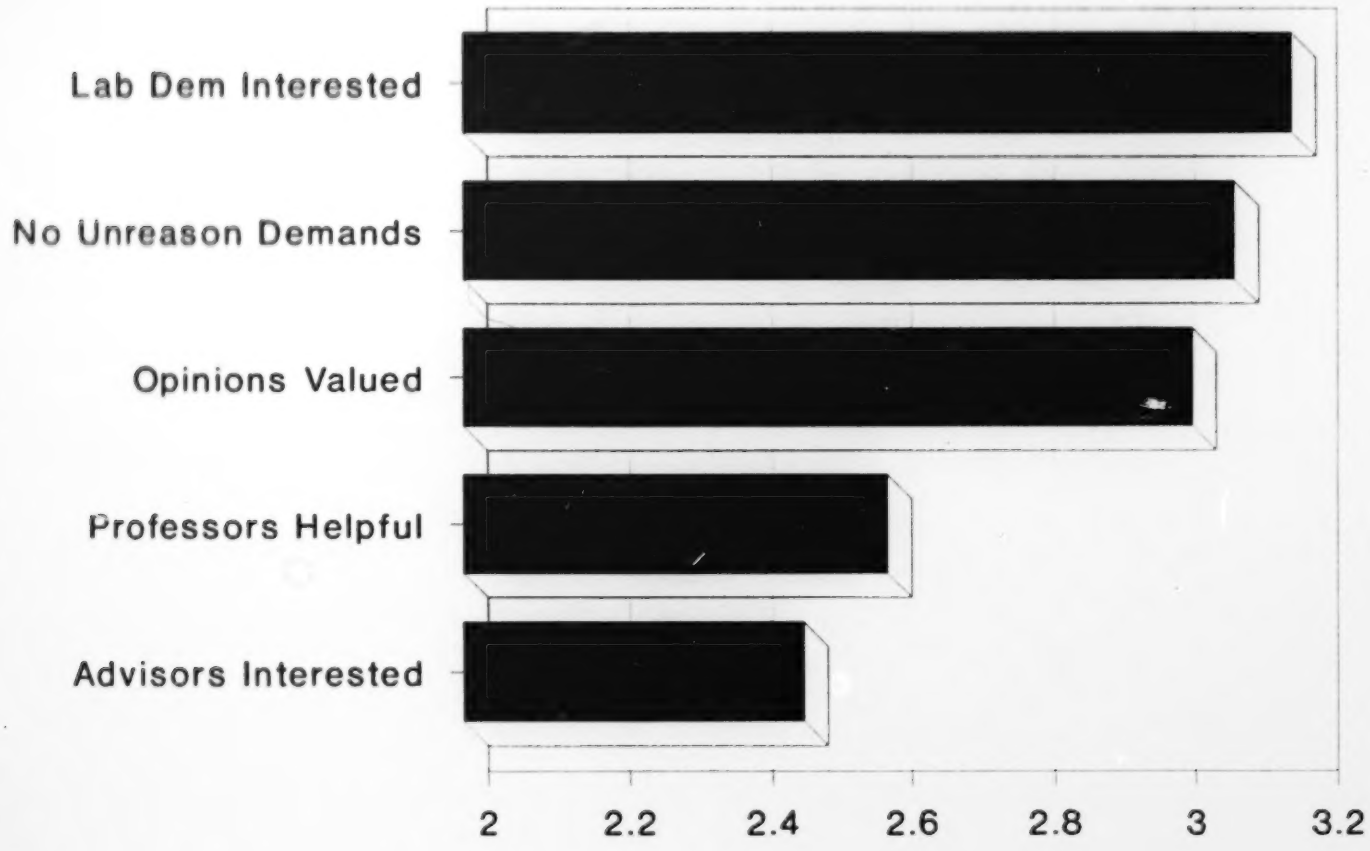
- Males, on average, belonged to .80 campus organizations whereas the comparable figure for females was .55.

- Males participated more in sports than females. The mean number of sports engaged in were .49 and .34 respectively.

- The only difference based on minority status was in the area of sports participation. The overall number of sports engaged in by minority students was .53; the comparable figure for non-minority students was a lower .37.

Four other measures of involvement that can be examined are the number of courses that students were enroled in by the end of the first year, the number of courses that had been dropped, and the average percentages of lectures and labs attended. When these dimensions are examined, differences can be found with regard to gender but not minority status.

Graph 2: Means for Students' Experiences with Faculty and Lab Demonstrators



Overall, by the end of the first year, students reported that they were enroled in 4.18 courses. The mean number of dropped courses was .58. Students reported that they attended approximately 92% of their lectures and 97% of their labs (given the number of empty seats in some lectures, these may be biased estimates!).

When the gender and minority dimensions are examined it appears as though non-minorities are taking slightly more courses than minorities - 4.26 compared to 4.04. Correspondingly, minorities reported dropping .70 courses compared to .52 for non-minorities. Apart from these findings, there were no other differences based on either gender or minority status.

Experiences with Faculty

In a recent examination of the university/college experiences of tens of thousands of American students, Astin reaffirms that the nature of the contact that students have with faculty is related to a number of affective and cognitive outcomes of the university experience.[4] In the study of science students at BigU a number of questions were asked that are relevant to this issue. More concretely, on a five point scale, with 1 meaning strongly disagree and 5 strongly agree, students were asked to agree or disagree with the statements that:

- Professors went out of their way to be helpful.
- Students opinions were valued in the classroom.
- Professors did not make unreasonable academic demands of students.
- Faculty advisors took a real interest in students assigned to them.
- Teaching assistants or lab demonstrators were interested in students' academic development.

The mean scores for each of these measures, in descending order, are detailed in Graph 2.

Of the items presented in the graph, students agree least that advisors are interested in students assigned to them and that professors went out of their way to be helpful. Agreement is higher that opinions were valued in the class, demands were not unreasonable, and lab demonstrators were interested in students' academic development.

More important than the actual scores on these items are potential differences that might be gender or minority based. When looked at with this concern in mind it became evident that males, with a mean score of 2.63, believed that faculty went out of their way to

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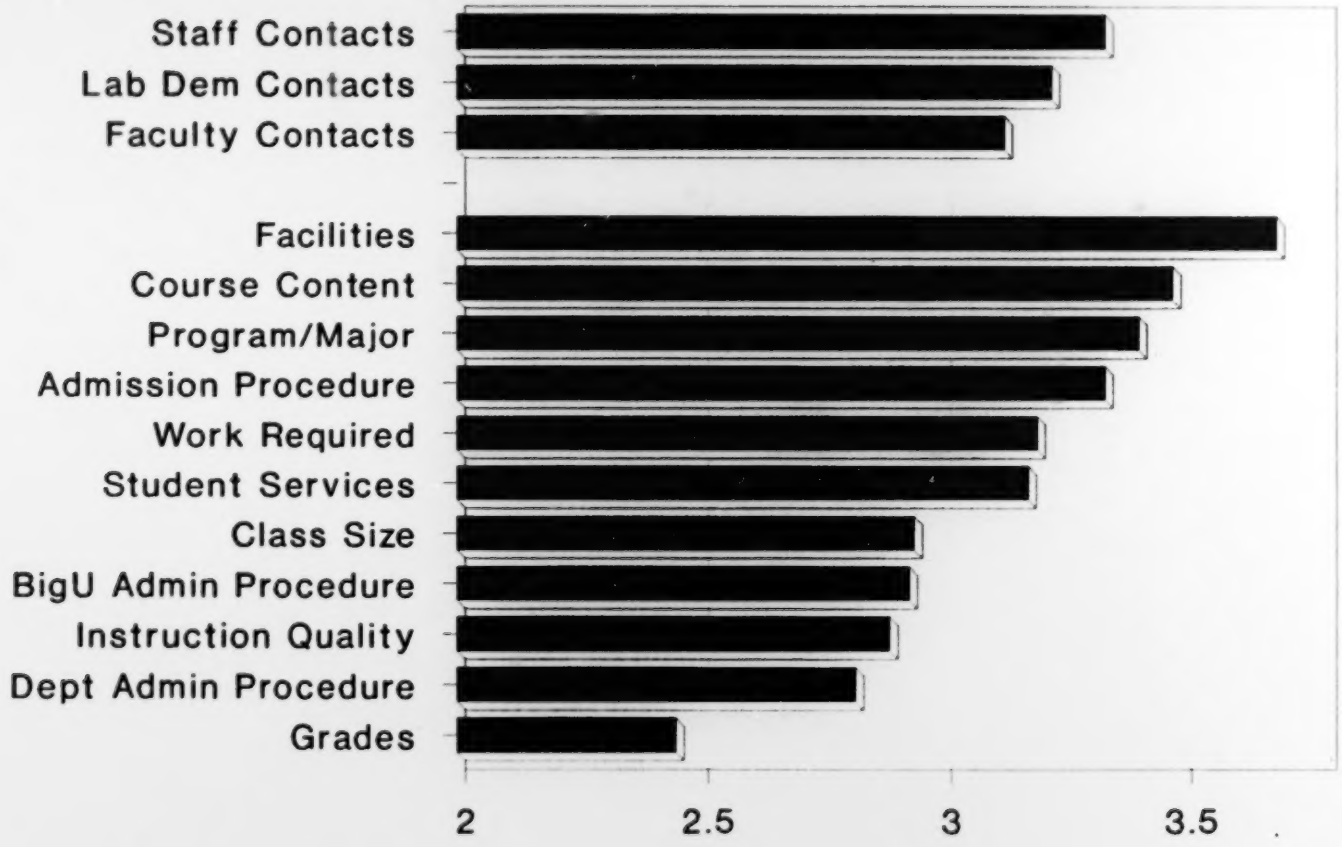
[4] Alexander Astin, What Matters in College. San Francisco: Jossey Bass, 1993.

Graph 3: Means for Students' Satisfaction with Various Experiences



be helpful to a greater extent than females with a mean score of 2.32; however, although the difference is statistically significant, its magnitude is not large. This is the only item on which there was a difference based on gender or visible minority status.

Of greater import, perhaps, is the fact that there are no differences based on gender or visible minority status regarding perceptions of the extent to which students' opinions were valued in the classroom. The importance of this finding is that it suggests that females and visible minority students may find the classroom climate no more, or less, chilling than other students.

Satisfaction with Experiences

In addition to obtaining information on the behaviour of faculty and lab demonstrators, questions were asked that focused on the satisfaction of students with various aspects of their university experience. More specifically, students were asked how satisfied they were with various matters where 1 indicated very dissatisfied and 5 very satisfied. The items covered by this line of questioning, and the associated mean scores, are presented in Graph 3.

To begin with satisfaction with the amount of contact with faculty, lab demonstrators, and staff, it seems that students are marginally more satisfied with the number of staff contacts than with contact with lab demonstrators and faculty. When it comes to other matters, students voice the greatest satisfaction with facilities and the least with grades. There is, however, no apparent pattern to items singled out for high or low satisfaction.

Of the 14 items listed in the graph, there are only two for which there are differences in scores based on the gender of the student. There is none for which being or not being a visible minority student has any significance. The two items for which there are gender differences are satisfaction with instruction quality and satisfaction with grades. In both cases males score higher than females. For satisfaction with instruction the means for males and females are 2.68 and 3.05 respectively. For satisfaction with marks the corresponding scores are 2.19 and 2.66. These two exceptions aside, overall, the satisfaction expressed with various aspects of university is the same for males and females and for members of visible minority groups and others. Just the same, as suggested elsewhere, compared to other universities, levels of satisfaction on many items appear to be low.[5]

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[5] J. Paul Grayson, Outcomes and Experiences of First Year Students in Two Universities. York University: Institute for Social Research, 1993.

Problem Areas

Students might expect problems from their association with the university as well as from external sources that impinge upon their university life. The degree to which science students actually confronted problems from such sources is outlined in Graph 4. In this instance a score of 1 indicated no problems at all while 5 meant that the item in question was very problematic.

While the scores for various items are interesting in themselves, as in other sections, the primary concern here is with differences based on gender and/or minority group status. As a result, only those items for which there are gender or minority/non-minority differences will be discussed. As will be seen, there are a considerable number of areas in which differences based on these criteria become manifest.

- First, with a score of 2.94, female students report more problems doing university level work than males with a score of 2.45.
- Second, females report more problems with accommodations than males: scores of 1.99 and 1.61 for females and males respectively.
- Third, female students had more problems than males in getting good grades - a mean of 3.79 compared to 3.21.
- Fourth, females experienced more problems with stress than males. For the former the mean was 3.39; for the latter, 2.64.
- Fifth, females reported that family problems interfered with studies to a greater extent than males: the respective means were 2.78 and 2.43.
- Sixth, the female mean for having problems with academic counselling was 2.97; the male mean 2.56.
- Seventh, females found more problems with instructors than males. The respective scores were 3.07 and 2.71.

In short, out of 18 possible areas in which students could identify problems, females reported more problems than males in seven. In order to put these findings in perspective it should be noted that in the survey carried out on the second day of class, female students expected more problems than male students.[6]

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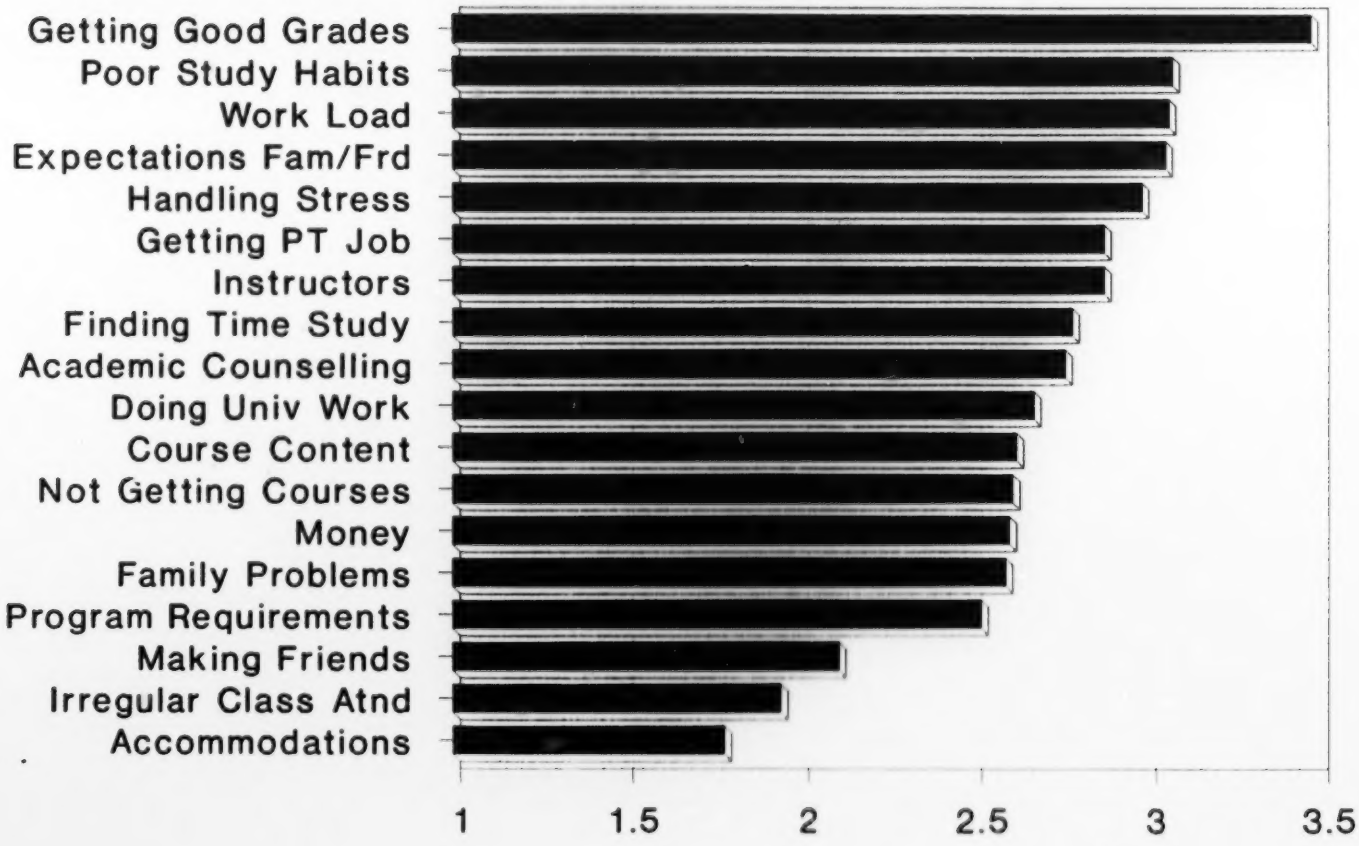
[6] J. Paul Grayson, Report #1: Preliminary Findings, Survey 1. Institute for Social Research, Internal Document, 1992.

Graph 4: Means for Students' Problem Areas



Minority students also report having found problems in a number of areas to a greater extent than non-minority students.

- First, minority students had comparatively more problems than others when it came to having enough money to meet expenses: the means were 2.81 and 2.49 respectively.

- Second, with a mean of 3.26, minority students encountered more problems in satisfying the expectations of family and friends than non-minority students with a mean of 2.95.

- Third, when it came to getting into the courses they wanted, minorities felt that they encountered more problems than other students. The respective means were 2.99 and 2.39.

- Fourth, the mean score of minorities with regard to having problems with meeting academic program requirements was 2.71; for others it was 2.42.

- Finally, with a mean score of 3.12 versus 2.55 minorities reported greater problems than others in the realm of academic counselling.

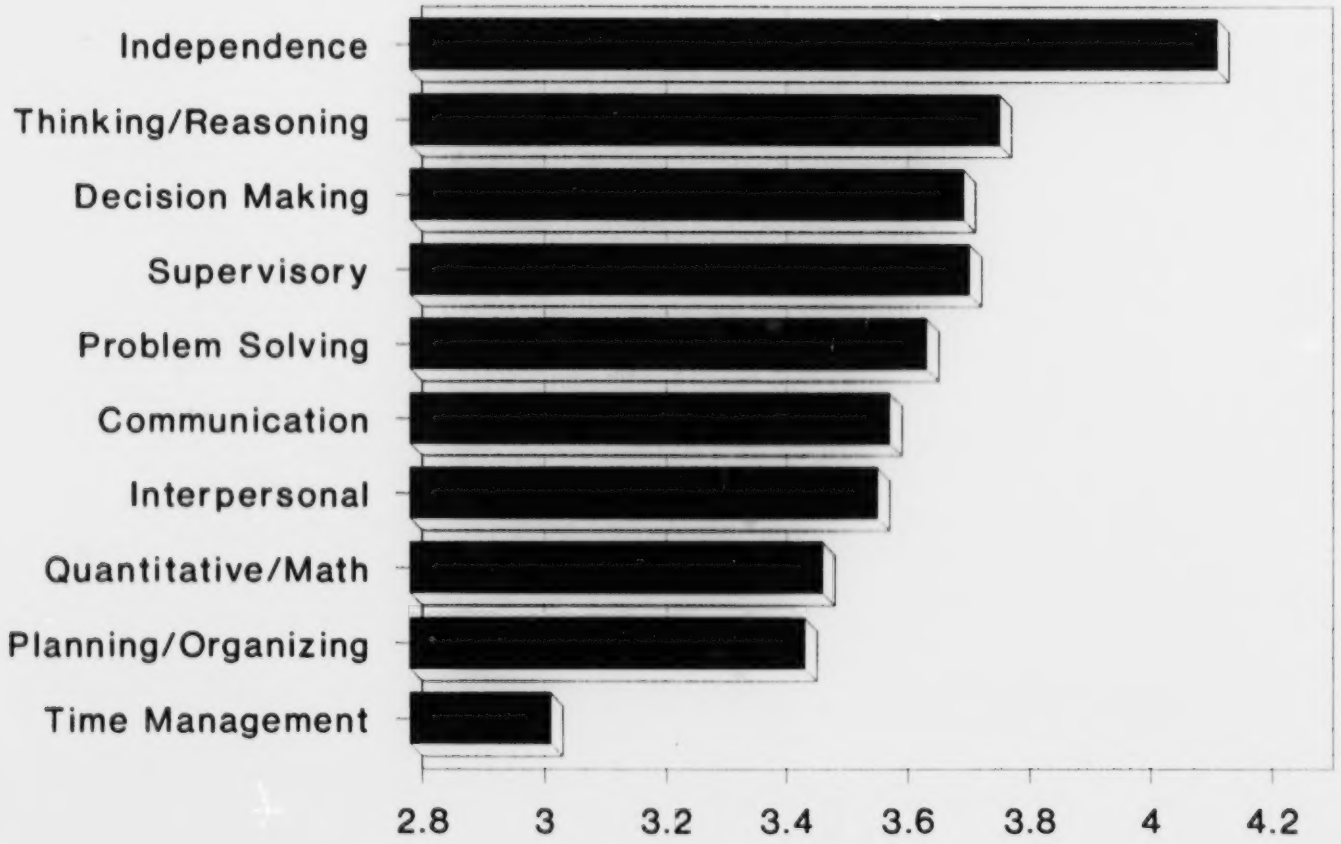
In view of the foregoing, it can be argued that both female and minority students report having more problems with various aspects of university life, or aspects of life that impinge upon university life, than either males or non-minorities. At the same time it should be remembered that the overwhelming majority of both female and minority students remarked that they were treated in the same way as other students by faculty, staff, and students. As a result, at least with regard to problems that arise directly from university life, it is difficult to say with certainty why female and minority students might experience more problems than others.

Competencies

In an earlier report it was pointed out that in the September survey both female and minority students tended to rank themselves lower than other individuals in their final year of high school with regard to a number of competencies. The same competencies are listed in Graph 5.[7] This time, however, students were asked to compare themselves to first year students they knew at BigU. Before moving on to examine any differences based on gender or minority status it is important to note that the two items on which students ranked

[7] J. Paul Grayson, Report #1: Preliminary Findings, Survey 1. Institute for Social Research, Internal Document, 1992.

Graph 5: Means for Students' Competencies



themselves lowest, time management and planning/organizing, were also identified in September as major areas of concern.

While in the September survey there were differences based on both gender and minority status, in the final survey the only differences to occur were gender based. In essence, in the intervening months, it appears as though there may have been an increase in the self-confidence of minority students. For females, however, it is a different story.

- First, females ranked themselves lower than males in thinking and reasoning skills. The respective means were 3.66 and 3.87.
- Second, while the mean score for males with regard to problem solving was 3.85, for females it was only 3.40.
- Third, females ranked their decision making skills lower than males: 3.59 compared to 3.81.
- Fourth, female students ranked their competency in quantitative mathematical skills at 3.21; the score for males was 3.69.

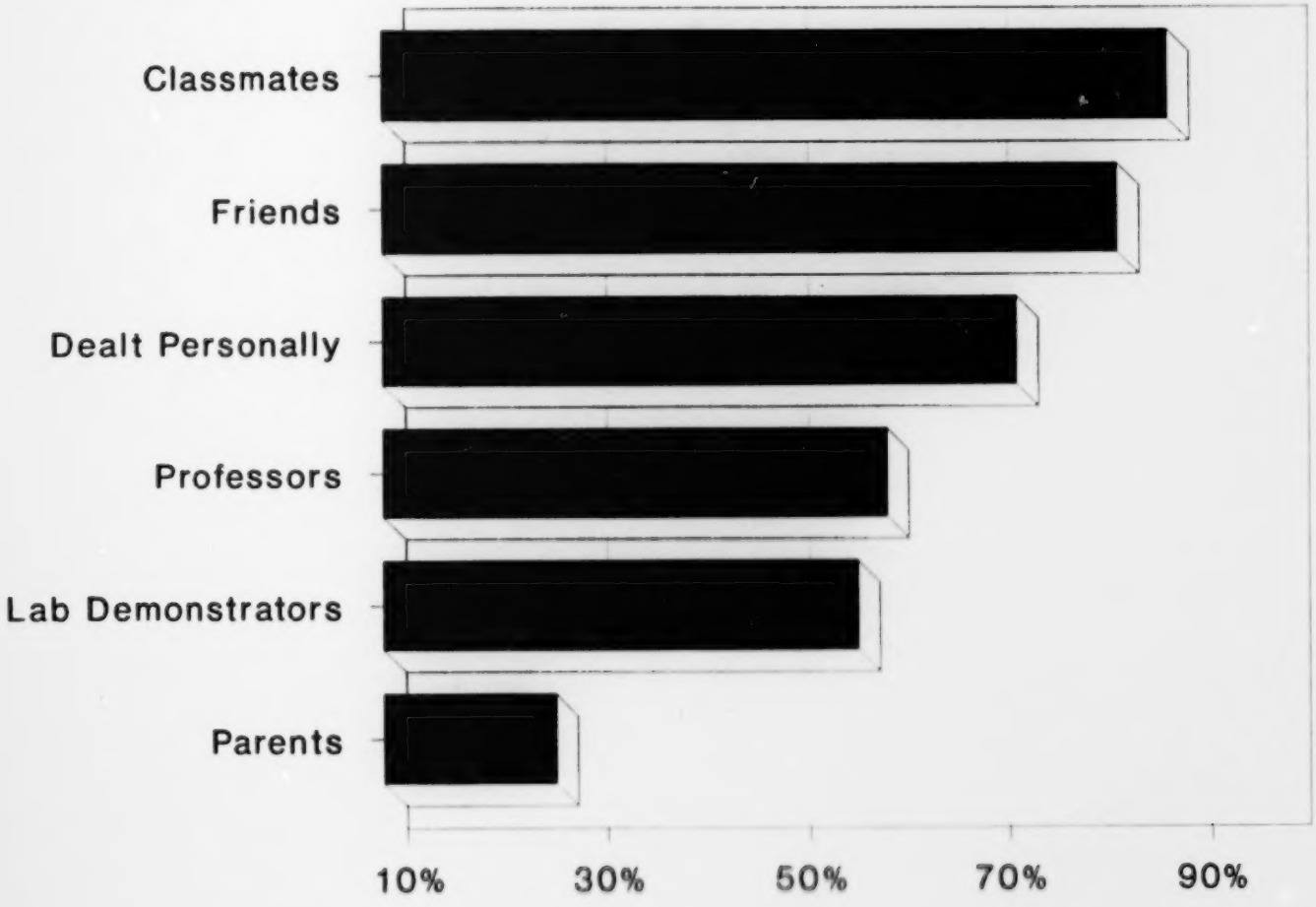
The foregoing figures indicate that although the grade point averages of females were the same as those of males, the former nonetheless tended to rank themselves relatively low with regard to a number of skills that presumably contribute to high grades. Taken collectively, these findings suggest that female students at the end of first year science are less self-confident than their male counterparts. This is not an uncommon finding.

Sources of Help

In total, by the time of the final first year survey, 81% of all students reported that they had encountered difficulties with their studies. The sources they turned to for help when faced with such problems are detailed in Graph 6. It should be noted that students may have identified more than one source of help and the graph reflects this possibility.

By far students attempted to deal with their academic problems in informal ways by turning to classmates and/or friends. Attempts at dealing with problems without assistance were also common. By way of comparison, faculty and lab demonstrators were turned to less often; parents were consulted least. When sources of help were examined in terms of gender and visible minority status, only one difference emerged: whereas 65% of female students stated that they sought the assistance of lab demonstrators, only 49% of males did so.

Graph 6: Students' Sources of Help



When study habits were examined, there were no differences based on gender or minority status. Overall, 72% of students stated that they studied by themselves and 28% that they studied both alone and with a group.

Control Over Academic Life

While the sources of the problem are not readily apparent, the foregoing analysis indicates that the first year science experiences of female and visible minority students may be less positive than those of others. As a result, it would be reasonable to assume that females and minorities would feel that they had less control over their academic life than other students.

In part, this assumption was borne out. When asked on a five point scale with 1 indicating no control and 5 a great deal of control how much control they had over their academic lives, the score for females was 3.06 and for males 3.47. There were, however, no statistically significant differences based on minority group status.

Conclusion

As noted in the introduction, the data analyzed for this study indicate that there are no differences in first year grade point averages of science students based on gender or visible minority status. Moreover, the results of a previous study suggest that a number of other outcomes of the first year experience may not vary by gender or visible minority group status. These facts aside, there is no doubt that the experience of female and visible minority students is different from that of other students. Among other things, to paint with very broad strokes and to focus on only two areas, female and minority group students, when compared to others, encounter more problems relevant to university life and females lack self-confidence.

These facts notwithstanding, it is far from easy to identify the sources of differences. For example, both females and minority students believe that they have been treated in the same way as other students and that their opinions are valued in the classroom. Moreover, although the point was not made in the body of the text, similar refrains were heard in the focus group meetings that were carried out concurrently with the surveys.

Perhaps the best explanation that can be offered for the observed patterns is that speaking in very general terms both female and minority students enter the university with relatively low expectations in some areas, relatively low self-confidence, and so on. This much was established in the September survey. Thereafter, they may define the encounters they have in the university in ways that are consistent with these predispositions. There is

nothing that occurs in the university context to reverse this process, at least in first year science.

This explanation was advanced prior to a reading of Alexander Astin's, What Matters in College, 1993. In the conclusion to his study of thousands of U.S. college and university students Astin focuses on a peer group interpretation of phenomena similar to those examined in this report. He writes that:

> Women are most likely to affiliate with women during college, and men are most likely to affiliate with men...As a consequence, women are more likely to be influenced by the values and behaviour of other women, and men are more likely to be influenced by the values and behaviour of other men. Such an interpretation is supported by the observation that *virtually every gender difference observed at input widens with time* (italics in original).[8]

Presumably, female students' women peers would reinforce predispositions to view university experiences in particular ways as advanced above. The same argument extends to members of visible minority groups. In essence, Astin's explanation is consistent with the one originally advanced in this study.

There are two final points that must be made in conclusion. First, while it would be desirable for students to have a uniformly positive university experience, the differences based on gender and/or visible minority status identified in this report, while statistically significant, are not usually large in an absolute sense. This does not mean that they can be dismissed; it simply means that they should be examined in a balanced way. Second, while the differences in the experiences of female and minority students may have few implications for certain outcomes of the first year of the science program (e.g., grade point averages), the extent to which the same will be true in future years can only be determined by additional research.

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[8] Alexander Astin, What Matters in College. San Francisco: Jossey Bass, 1993, p. 406.

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